

C1
Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through, and
one of said first semiconductor die and said second semiconductor die is
positioned such that said conductive bond pad on one of said first and second
active surfaces is aligned with said passage.

2. A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including
at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface
including at least one conductive bond pad;

an intermediate substrate positioned between said first semiconductor die and said second
semiconductor die such that a first surface of said intermediate substrate faces said first
semiconductor die and such that a second surface of said intermediate substrate faces said second
semiconductor die, wherein

said intermediate substrate defines a passage there through, and
one of said first semiconductor die and said second semiconductor die is
positioned such that said conductive bond pad on one of said first and second
active surfaces is aligned with said passage; and

at least one decoupling capacitor conductively coupled to at least one of said first and
second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is
accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,
said second semiconductor die,
a topographic contact conductively coupled to said first semiconductor
die, and
a topographic contact conductively coupled to said second semiconductor
die.

C2
3. (Amended) A multiple die semiconductor assembly comprising:

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

ca a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

a single intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through, and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage; and

a heat sink including a cap portion and a peripheral portion, wherein

said cap portion is thermally coupled to a major surface of at least one of said first and second semiconductor dies, and

said peripheral portion engages a mounting zone defined by a lateral dimension of said intermediate substrate extending beyond a periphery of at least one of said first and second semiconductor dies.

4. A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad; and

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate,

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

said intermediate substrate defines a passage there through,
said second semiconductor die is secured to said second surface of said intermediate substrate such that said conductive bond pad of said second semiconductor die is aligned with said passage, and
said second semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said first surface of said intermediate substrate.

5. (Amended) A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said second semiconductor die and said first active surface of said first semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,
said first semiconductor die is secured to said first surface of said intermediate substrate such that said conductive bond pad of said first semiconductor die is aligned with said passage, and

said first semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said second surface of said intermediate substrate; and

an additional substrate positioned such that a first surface of said additional substrate faces said second active surface of said second semiconductor die and such that said first surface of said additional substrate opposes said second surface of said intermediate substrate, wherein

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

3
said additional substrate defines an additional passage there through,
said second semiconductor die is secured to said first surface of said
additional substrate such that said conductive bond pad of said second
semiconductor die is aligned with said additional passage, and
said second semiconductor die is electrically coupled to said additional
substrate by at least one conductive line extending from said conductive bond pad
of said second semiconductor die through said additional passage defined in said
additional substrate and to a conductive contact on a second surface of said
additional substrate.

6. A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including
at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface
including at least one conductive bond pad;

an intermediate substrate positioned between said first active surface of said first
semiconductor die and said second active surface of said second semiconductor die such that a
first surface of said intermediate substrate faces said first active surface and such that a second
surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate
substrate by at least one topographic contact extending from said first active
surface to said first surface of said intermediate substrate,

said intermediate substrate defines a passage there through,

said second semiconductor die is secured to said second surface of said
intermediate substrate such that said conductive bond pad of said second
semiconductor die is aligned with said passage, and

said second semiconductor die is electrically coupled to said intermediate
substrate by at least one conductive line extending from said conductive bond pad
of said second semiconductor die through said passage defined in said
intermediate substrate and to a conductive contact on said first surface of said
intermediate substrate; and

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,

said second semiconductor die,

a topographic contact conductively coupled to said first semiconductor

die, and

a topographic contact conductively coupled to said second semiconductor

die.

7. A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said second semiconductor die and said first active surface of said first semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,

said first semiconductor die is secured to said first surface of said intermediate substrate such that said conductive bond pad of said first semiconductor die is aligned with said passage, and

said first semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said second surface of said intermediate substrate;

an additional substrate positioned such that a first surface of said additional substrate faces said second active surface of said second semiconductor die, wherein

said additional substrate defines an additional passage there through,

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

said second semiconductor die is secured to said first surface of said additional substrate such that said conductive bond pad of said second semiconductor die is aligned with said additional passage, and

said second semiconductor die is electrically coupled to said additional substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said additional passage defined in said additional substrate and to a conductive contact on a second surface of said additional substrate; and

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,

said second semiconductor die,

a topographic contact conductively coupled to said first semiconductor die, and

a topographic contact conductively coupled to said second semiconductor die.

8. A multiple die semiconductor assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad; and

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate, and

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

said second semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said second active surface to said second surface of said intermediate substrate.

9. A multiple die semiconductor assembly as claimed in claim 8 wherein said assembly further comprises at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said topographic contact extending from said first active surface to said first surface of said intermediate substrate.

Cy
10. (Amended) A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

a single intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through, and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage;

a printed circuit board positioned such that a first surface of said printed circuit board faces said intermediate substrate; and

a plurality of topographic contacts extending from said intermediate substrate to said first surface of said printed circuit board.

11. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through, and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage;

a printed circuit board positioned such that a first surface of said printed circuit board faces said intermediate substrate;

a plurality of topographic contacts extending from said intermediate substrate to said first surface of said printed circuit board; and

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,

said second semiconductor die,

a topographic contact conductively coupled to said first semiconductor die, and

a topographic contact conductively coupled to said second semiconductor die.

12. (Amended) A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

a single intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first

CS
Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through, and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage;

a printed circuit board positioned such that a first surface of said printed circuit board faces said intermediate substrate;

a plurality of topographic contacts extending from said intermediate substrate to said first surface of said printed circuit board; and

a heat sink including a cap portion and a peripheral portion, wherein

said cap portion is thermally coupled to a major surface of at least one of said first and second semiconductor dies, and

said peripheral portion engages a mounting zone defined by a lateral dimension of said intermediate substrate extending beyond a periphery of at least one of said first and second semiconductor dies.

13. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate,

said intermediate substrate defines a passage there through,

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

said second semiconductor die is secured to said second surface of said intermediate substrate such that said conductive bond pad of said second semiconductor die is aligned with said passage, and

said second semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said first surface of said intermediate substrate;

a printed circuit board positioned such that a first surface of said printed circuit board faces said second surface of said intermediate substrate and such that said second semiconductor die is positioned between said printed circuit board and said intermediate substrate; and

a plurality of topographic contacts extending from said second surface of said intermediate substrate to said first surface of said printed circuit board.

Cb
14. (Amended) A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said second semiconductor die and said first active surface of said first semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,

said first semiconductor die is secured to said first surface of said intermediate substrate such that said conductive bond pad of said first semiconductor die is aligned with said passage, and

said first semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

substrate and to a conductive contact on said second surface of said intermediate substrate;

an additional substrate positioned such that a first surface of said additional substrate faces said second active surface of said second semiconductor die and such that said first surface of said additional substrate opposes said second surface of said intermediate substrate, wherein

said additional substrate defines an additional passage there through, said second semiconductor die is secured to said first surface of said additional substrate such that said conductive bond pad of said second semiconductor die is aligned with said additional passage, and

said second semiconductor die is electrically coupled to said additional substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said additional passage defined in said additional substrate and to a conductive contact on a second surface of said additional substrate;

a printed circuit board positioned such that a first surface of said printed circuit board faces said second surface of said additional substrate and such that said conductive line extends through a space defined between said second surface of said additional substrate and said first surface of said printed circuit board; and

a plurality of topographic contacts extending from said second surface of said additional substrate to said first surface of said printed circuit board.

15. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate,

said intermediate substrate defines a passage there through,

said second semiconductor die is secured to said second surface of said intermediate substrate such that said conductive bond pad of said second semiconductor die is aligned with said passage, and

said second semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said first surface of said intermediate substrate;

a printed circuit board positioned such that a first surface of said printed circuit board faces said second surface of said intermediate substrate and such that said second semiconductor die is positioned between said printed circuit board and said intermediate substrate;

a plurality of topographic contacts extending from said second surface of said intermediate substrate to said first surface of said printed circuit board; and

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,

said second semiconductor die,

a topographic contact conductively coupled to said first semiconductor die, and

a topographic contact conductively coupled to said second semiconductor die.

16. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said second semiconductor die and said first active surface of said first semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,

said first semiconductor die is secured to said first surface of said intermediate substrate such that said conductive bond pad of said first semiconductor die is aligned with said passage, and

said first semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said second surface of said intermediate substrate;

an additional substrate positioned such that a first surface of said additional substrate faces said second active surface of said second semiconductor die, wherein

said additional substrate defines an additional passage there through,

said second semiconductor die is secured to said first surface of said additional substrate such that said conductive bond pad of said second semiconductor die is aligned with said additional passage, and

said second semiconductor die is electrically coupled to said additional substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said additional passage defined in said additional substrate and to a conductive contact on a second surface of said additional substrate;

a printed circuit board positioned such that a first surface of said printed circuit board faces said second surface of said additional substrate and such that said conductive line extends through a space defined between said second surface of said additional substrate and said first surface of said printed circuit board;

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

a plurality of topographic contacts extending from said second surface of said additional substrate to said first surface of said printed circuit board; and

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

said first semiconductor die,

said second semiconductor die,

a topographic contact conductively coupled to said first semiconductor die, and

a topographic contact conductively coupled to said second semiconductor die.

17. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate, and

said second semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said second active surface to said second surface of said intermediate substrate;

a printed circuit board positioned such that a first surface of said printed circuit board faces said second surface of said intermediate substrate and such that said second semiconductor die is positioned between said printed circuit board and said intermediate substrate; and

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

a plurality of topographic contacts extending from said second surface of said intermediate substrate to said first surface of said printed circuit board.

18. A printed circuit board assembly as claimed in claim 17 further comprising a decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said topographic contact extending from said first active surface to said first surface of said intermediate substrate.

19. A printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface, wherein

said first semiconductor die is electrically coupled to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate,

said intermediate substrate defines a passage there through,

said second semiconductor die is secured to said second surface of said intermediate substrate such that said conductive bond pad of said second semiconductor die is aligned with said passage, and

said second semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said first surface of said intermediate substrate;

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

at least one decoupling capacitor mounted to said first surface of said intermediate substrate and conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of a topographic contact conductively coupled to a conductive contact on said first surface of said intermediate substrate; and

a heat sink including a cap portion and a peripheral portion, wherein

said cap portion is thermally coupled to a major surface of at least one of said first and second semiconductor dies, and

said peripheral portion engages a mounting zone defined by a lateral dimension of said intermediate substrate extending beyond a periphery of at least one of said first and second semiconductor dies.

20. (Amended) A computer system comprising:

a programmable controller; and

at least one memory unit, wherein said memory unit comprises a printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad; a single intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,

and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage;

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

27
a printed circuit board positioned such that a first surface of said printed circuit board faces said intermediate substrate; and

a plurality of topographic contacts extending from said intermediate substrate to said first surface of said printed circuit board.

21. (Amended) A computer system comprising:

a programmable controller; and

at least one memory unit, wherein said memory unit comprises a printed circuit board assembly comprising:

a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

an intermediate substrate positioned between said first semiconductor die and said second semiconductor die such that a first surface of said intermediate substrate faces said first semiconductor die and such that a second surface of said intermediate substrate faces said second semiconductor die, wherein

said intermediate substrate defines a passage there through,

and

one of said first semiconductor die and said second semiconductor die is positioned such that said conductive bond pad on one of said first and second active surfaces is aligned with said passage;

a printed circuit board positioned such that a first surface of said printed circuit board faces said intermediate substrate;

a plurality of topographic contacts extending from said intermediate substrate to said first surface of said printed circuit board; and

at least one decoupling capacitor conductively coupled to at least one of said first and second semiconductor dies, wherein a thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of one of

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

07
said first semiconductor die,
said second semiconductor die,
a topographic contact conductively coupled to said first
semiconductor die, and
a topographic contact conductively coupled to said second
semiconductor die.

22. (Amended) A computer system comprising:

a programmable controller; and

at least one memory unit, wherein said memory unit comprises a printed circuit board
assembly comprising:

a first semiconductor die defining a first active surface, said first active
surface including at least one conductive bond pad;

a second semiconductor die defining a second active surface, said second
active surface including at least one conductive bond pad;

a single intermediate substrate positioned between said first semiconductor
die and said second semiconductor die such that a first surface of said
intermediate substrate faces said first semiconductor die and such that a second
surface of said intermediate substrate faces said second semiconductor die,
wherein

said intermediate substrate defines a passage there through,

and

one of said first semiconductor die and said second
semiconductor die is positioned such that said conductive bond pad
on one of said first and second active surfaces is aligned with said
passage;

a printed circuit board positioned such that a first surface of said printed
circuit board faces said intermediate substrate;

a plurality of topographic contacts extending from said intermediate
substrate to said first surface of said printed circuit board; and

a heat sink including a cap portion and a peripheral portion, wherein

27
Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

said cap portion is thermally coupled to a major surface of at least one of said first and second semiconductor dies, and said peripheral portion engages a mounting zone defined by a lateral dimension of said intermediate substrate extending beyond a periphery of at least one of said first and second semiconductor dies.

23. A method of stacking a plurality of semiconductor die comprising:

providing a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

providing a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

positioning an intermediate substrate between said first active surface of said first semiconductor die and said second active surface of said second semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second active surface;

electrically coupling said first semiconductor die to said intermediate substrate by at least one topographic contact extending from said first active surface to said first surface of said intermediate substrate;

securing said second semiconductor die to said second surface of said intermediate substrate such that said conductive bond pad of said second semiconductor die is aligned with a passage formed through said intermediate substrate;

electrically coupling said second semiconductor die to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said first surface of said intermediate substrate;

positioning a printed circuit board such that a first surface of said printed circuit board faces said second surface of said intermediate substrate and such that said second semiconductor die is positioned between said printed circuit board and said intermediate substrate; and

forming a plurality of topographic contacts extending from said second surface of said intermediate substrate to said first surface of said printed circuit board.

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

24. (Amended) A method of stacking a plurality of semiconductor die comprising:

providing a first semiconductor die defining a first active surface, said first active surface including at least one conductive bond pad;

providing a second semiconductor die defining a second active surface, said second active surface including at least one conductive bond pad;

positioning an intermediate substrate between said second semiconductor die and said first active surface of said first semiconductor die such that a first surface of said intermediate substrate faces said first active surface and such that a second surface of said intermediate substrate faces said second semiconductor die;

securing said first semiconductor die to said first surface of said intermediate substrate such that said conductive bond pad of said first semiconductor die is aligned with a passage formed in said intermediate substrate;

electrically coupling said first semiconductor die to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate substrate and to a conductive contact on said second surface of said intermediate substrate;

providing an additional substrate positioned such that a first surface of said additional substrate faces said second active surface of said second semiconductor die and such that said first surface of said additional substrate opposes said second surface of said intermediate substrate;

securing said second semiconductor die to said first surface of said additional substrate such that said conductive bond pad of said second semiconductor die is aligned with an additional passage formed in said additional substrate;

electrically coupling said second semiconductor die to said additional substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor die through said additional passage defined in said additional substrate and to a conductive contact on a second surface of said additional substrate;

positioning a printed circuit board such that a first surface of said printed circuit board faces said second surface of said additional substrate and such that said conductive line extends

28
Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

through a space defined between said second surface of said additional substrate and said first surface of said printed circuit board; and

forming a plurality of topographic contacts extending from said second surface of said additional substrate to said first surface of said printed circuit board.

25. A multiple die semiconductor assembly as claimed in claim 1 wherein said first semiconductor die comprises a flip chip arranged relative to said intermediate substrate such that said conductive bond pads included in said first active surface are aligned with conductive contacts on said first surface of said intermediate substrate.

26. A multiple die semiconductor assembly as claimed in claim 25 wherein said multiple die semiconductor assembly further comprises topographic contacts extending between said conductive bond pads of said first active surface and said conductive contacts of said first surface of said intermediate substrate.

27. A multiple die semiconductor assembly as claimed in claim 1 wherein said second semiconductor die comprises a flip chip arranged relative to said intermediate substrate such that said conductive bond pads included in said second active surface are aligned with a conductive contact on said second surface of said intermediate substrate.

28. A multiple die semiconductor assembly as claimed in claim 27 wherein said multiple die semiconductor assembly further comprises topographic contacts extending between said conductive bond pads of said second active surface and said conductive contacts of said second surface of said intermediate substrate.

29. A multiple die semiconductor assembly as claimed in claim 1 wherein said first semiconductor die comprises a stacked chip secured to said first surface of said intermediate substrate such that said conductive bond pads on said first active surface are aligned with said passage.

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

30. A multiple die semiconductor assembly as claimed in claim 29 wherein said multiple die semiconductor assembly further comprises conductive lines extending from said conductive bond pads on said first active surface to conductive contacts on said second surface of said intermediate substrate.

31. A multiple die semiconductor assembly as claimed in claim 1 wherein said second semiconductor die comprises a stacked chip secured to said second surface of said intermediate substrate such that said conductive bond pad on said second active surface is aligned with said passage.

32. A multiple die semiconductor assembly as claimed in claim 31 wherein said multiple die semiconductor assembly further comprises conductive lines extending from said conductive bond pads on said second active surface to conductive contacts on said first surface of said intermediate substrate.

33. A multiple die semiconductor assembly as claimed in claim 1 wherein:
said first semiconductor die is electrically coupled to said intermediate substrate; and
said second semiconductor die is electrically coupled to said intermediate substrate.

34. A multiple die semiconductor assembly as claimed in claim 1 wherein said first semiconductor die is electrically coupled to said second semiconductor die.

35. A multiple die semiconductor assembly as claimed in claim 1 wherein:
said first semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said first semiconductor die through said passage defined in said intermediate substrate and to said second surface of said intermediate substrate.

36. A multiple die semiconductor assembly as claimed in claim 1 wherein:
said second semiconductor die is electrically coupled to said intermediate substrate by at least one conductive line extending from said conductive bond pad of said second semiconductor

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

die through said passage defined in said intermediate substrate and to said first surface of said intermediate substrate.

37. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises an underfill material formed over said first surface of said intermediate substrate.

38. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises an underfill material formed between said first semiconductor die and said first surface of said intermediate substrate.

39. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises an encapsulant formed over said first semiconductor die and said first surface of said intermediate substrate.

40. A multiple die semiconductor assembly as claimed in claim 39 wherein said assembly further comprises an underfill material formed between said first semiconductor die and said first surface of said intermediate substrate.

41. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises an encapsulant formed over said first semiconductor die and said first surface of said intermediate substrate and between said first semiconductor die and said first surface of said intermediate substrate.

42. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises an encapsulant formed over said second semiconductor die.

43. A multiple die semiconductor assembly as claimed in claim 1 wherein said assembly further comprises a die attach adhesive positioned to secure said second semiconductor die to said second surface of said intermediate substrate.

44. A multiple die semiconductor assembly as claimed in claim 4 wherein:

Ser. No. 09/804,051
Atty. Dkt. No. MIO 0069 PA

said topographic contact defines a space between said first active surface and said first surface of said intermediate substrate;

said at least one conductive line extends through said space defined between said first active surface and said first surface of said intermediate substrate.

45. A multiple die semiconductor assembly as claimed in claim 6 wherein:

said decoupling capacitor is mounted to said first surface of said intermediate substrate;

and

the thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of a topographic contact conductively coupled to a conductive contact on said first surface of said intermediate substrate.

46. A multiple die semiconductor assembly as claimed in claim 45 wherein the thickness dimension of said decoupling capacitor is accommodated in a space further defined by a thickness dimension of said first semiconductor die.

47. A multiple die semiconductor assembly as claimed in claim 6 wherein:

said assembly comprises a pair of decoupling capacitors mounted to said first surface of said intermediate substrate; and

said first semiconductor die is positioned between said pair of decoupling capacitors relative to said first surface of said intermediate substrate.

48. A multiple die semiconductor assembly as claimed in claim 6 wherein:

said decoupling capacitor is mounted to said first surface of said intermediate substrate;

and

the thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said first semiconductor die conductively coupled to said first surface of said intermediate substrate.

49. A multiple die semiconductor assembly as claimed in claim 7 wherein:

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

said assembly further comprises a third substrate positioned such that a first surface of said third substrate faces said second surface of said additional substrate;

said additional substrate is electrically coupled to said third substrate by at least one topographic contact extending from said second surface of said additional substrate to a first surface of said third substrate;

said decoupling capacitor is mounted to said first surface of said third substrate; and

the thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said topographic contact extending from said second surface of said additional substrate to a first surface of said third substrate.

50. A multiple die semiconductor assembly as claimed in claim 7 wherein:

said assembly further comprises a third substrate positioned such that a first surface of said intermediate substrate faces a second surface of said third substrate;

said intermediate substrate is electrically coupled to said third substrate by at least one topographic contact extending from said second surface of said third substrate to said first surface of said intermediate substrate;

said decoupling capacitor is mounted to said second surface of said third substrate; and

the thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said topographic contact extending from said second surface of said third substrate to said first surface of said intermediate substrate.

51. A multiple die semiconductor assembly as claimed in claim 50 wherein the thickness dimension of said decoupling capacitor and a thickness dimension of said first semiconductor die are both accommodated in said space defined by the thickness dimension of said topographic contact extending from said second surface of said third substrate to said first surface of said intermediate substrate.

52. A multiple die semiconductor assembly as claimed in claim 7 wherein:

said decoupling capacitor is mounted to said first surface of said intermediate substrate;

and

Ser. No. 09/804,051

Atty. Dkt. No. MIO 0069 PA

the thickness dimension of said decoupling capacitor is accommodated in a space defined by a thickness dimension of said first semiconductor die.

53. A multiple die semiconductor assembly as claimed in claim 52 wherein:

said assembly comprises a pair of decoupling capacitors mounted to said first surface of said intermediate substrate; and

said first semiconductor die is positioned between said pair of decoupling capacitors relative to said first surface of said intermediate substrate.